

2. SPECIFICATIONS

2.3 SPECIFICATIONS AND PERFORMANCE

SPEED AND GRADEABILITY

Model	E55B				
Applicable Machines	PS02-00101~				
Shoe Type	Rubber shoe			Iron shoe (OPT)	
Slewing Speed	min ⁻¹ {rpm}	8.9 {8.9}			
Travel Speed	km/h (mph)	Low (1st)	High (2nd)	Low (1st)	High (2nd)
		2.7	4.6	2.7	4.6
Gradeability	% (degree)	58(30)			

ENGINE

Model (YANMAR)	4TNV88-BXPYBD (EDM-4TNV88)			
Type	Water-cooled, 4-cycle type Swirl chamber type diesel engine			
Number of cylinders-Bore X Stroke	4 - 88 dia. mm X 90 mm (3.46 in X 3.54 in)			
Total Displacement	L	2.189 (134 cu-in)		
Output Rating	kW/min ⁻¹ {PS/rpm}	29.1/2,400 {40/2,400}		
Maximum Torque	N-m/min ⁻¹ (lbf-ft/rpm)	131/1,440 (97/1,440)		
Starting Motor	V X kW	12 X 2.3		
Generator	V X A	12 X 55		

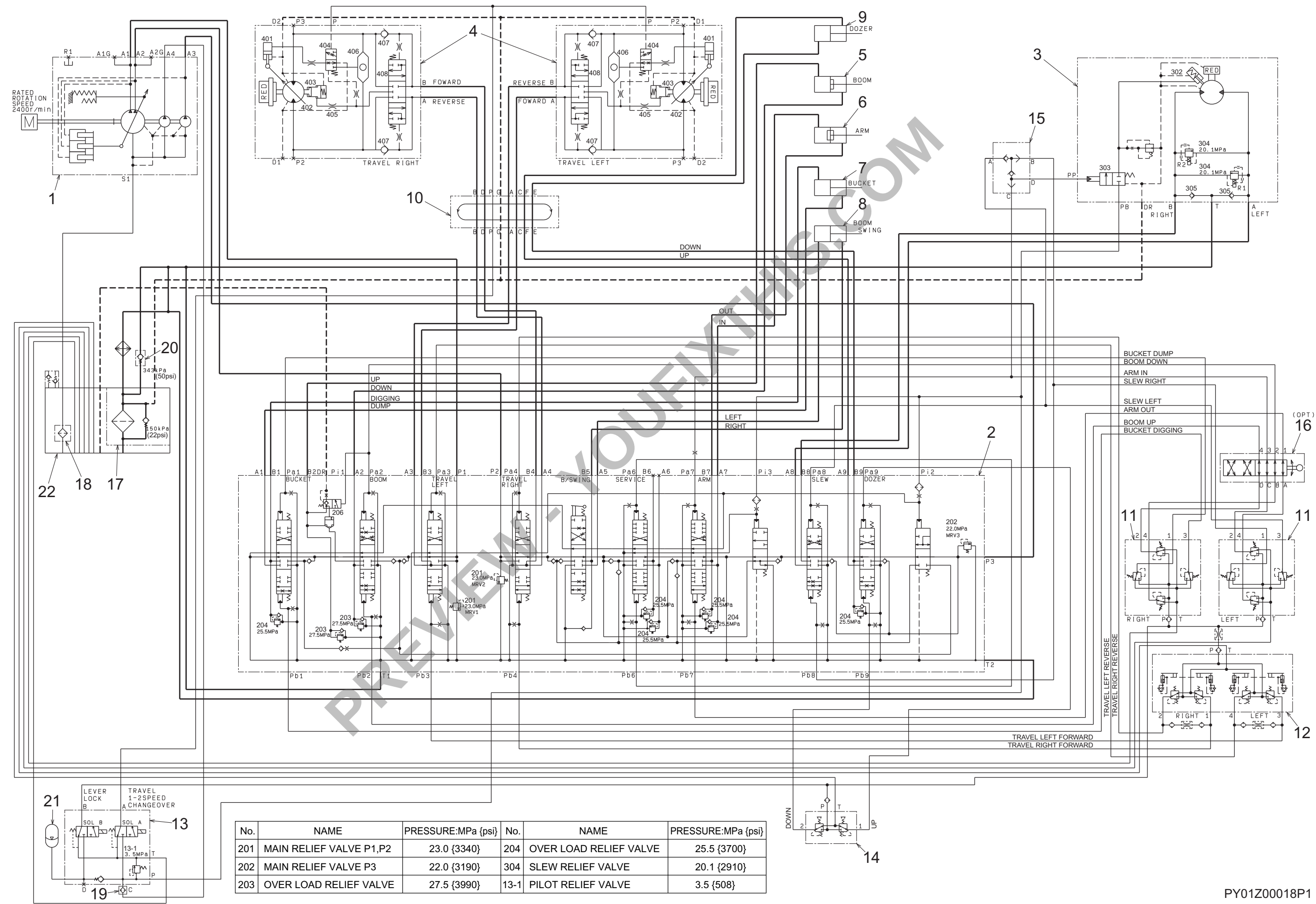
HYDRAULIC COMPONENTS

Hydraulic Pump	Variable displacement axial piston + gear pump			
Hydraulic Motor	Axial piston			
Hydraulic Motor w/Reducer (Travel)	2-Axial piston, 2-Speed motor			
Control Valve	11-spool multiple control valve			
Cylinder (Boom, Arm, Swing, Bucket, Dozer)	Double action cylinder			
Return Filter	Safety valve containing/Filter Type (30μ)			

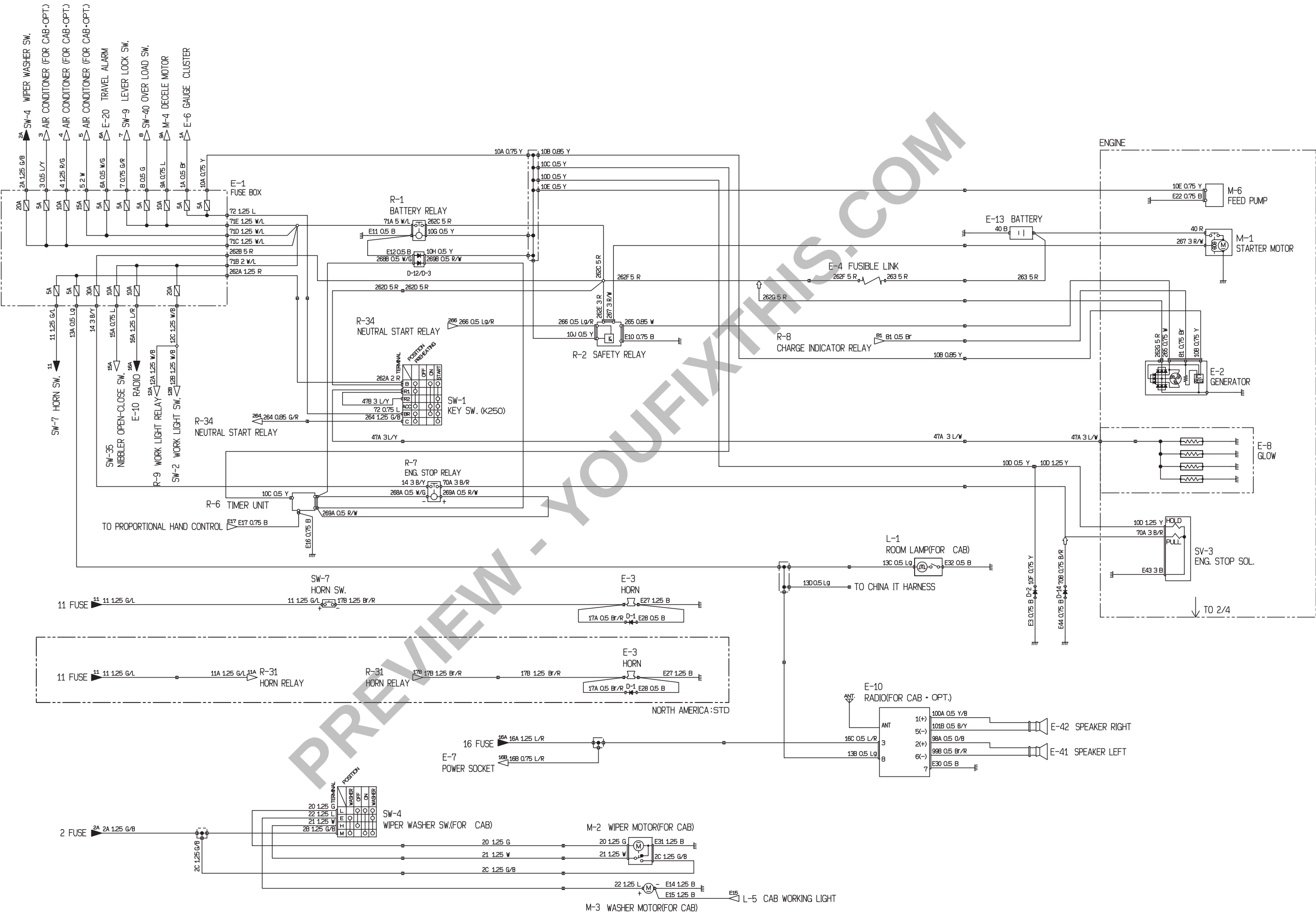
SIDE DIGGING & DOZER

Type		Boom swing by hydraulic cylinder	
Boom Swing Angle	Right	60 degrees	
	Left	70 degrees	
Stroke of Dozer (above/below)	mm (in)	497 / 373 (19.6/14.7)	

22.2.1 STANDARD SPECIFICATION



23.2.3 ELECTRIC CIRCUIT DIAGRAM



31.1 GENERAL DISASSEMBLY AND ASSEMBLY

31.1.1 CONTENTS OF GENERAL DISASSEMBLY AND ASSEMBLY

This chapter consists of three sections as follows.

- (1) ATTACHMENT: Index No.: 32
 - Part I: Removing and Installing Assembly
 - Part II: Disassembling and Assembling Components
 - 1. Hydraulic cylinder
- (2) UPPER SLEWING STRUCTURE: Index No.: 33
 - Part I: Removing and Installing Assembly
 - Part II: Disassembling and Assembling Components
 - 1. Hydraulic pump
 - 2. Control Valve
 - 3. Pilot Valve (ATT)
 - 4. Pilot Valve (Travel)
 - 5. Slewing Motor
 - 6. Swivel Joint
- (3) TRAVEL SYSTEM: Index No.: 34
 - Part I: Removing and Installing Assembly
 - Part II: Disassembling and Assembling Components
 - 1. Travel Motor

31.1.2 SPECIFICATION OF TIGHTENING TORQUE

Tightening torque is indicated as follows, for example;

T=100 N-m (73.8 lb-ft)

Tolerance is $\pm 10\%$ unless otherwise specified.

- Refer Index No. 11 TOOLS for standard tightening torque.

42.1 GENERAL PRECAUTIONS

Troubleshooting provides the process to investigate the cause of the trouble in order when trouble occurs. This manual describes how to solve the specific phenomenon systematically as quick as possible. For the troubleshooting concerning the inside of equipment, refer to the troubleshooting for each component manual of the equipment.

42.1.1 CONFIRM ACTUAL TROUBLED CONDITIONS AT SITE

(1) Get To The Site As Quickly As Possible.

Verify the machine model, serial number, situation of trouble and field, and notify possible arrival time to the user.



Make Field Investigation

(2) Verify background of the problem.

1. Model name and serial number.
2. Kind of attachment.
Check that the combination of attachments was proper and that the operating manner was not unreasonable.
3. Operating time on the hour-meter.
4. Record of troubles.
First trouble or repeated trouble.
5. History of the trouble and additional modifications.
Reoccurrence of the same trouble in the past or trouble due to additional modification.



Verifying Background of Trouble Occurred

(3) How to Diagnose Trouble

1. Verify defective part.
2. Reproduce the troubled conditions.
3. Where the defective part can not be verified, surmise the possible causes systematically.
4. Verify the surmised cause.
5. Report estimated repairing method, procedures and terms to the user.



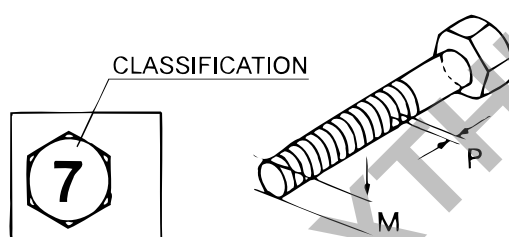
Diagnosing Trouble By Means Troubleshooting

11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS & NUTS

The following Torque Specifications are provided for use when the actual torque value of a fastener is not known. Check the capscrews and nuts for their looseness and dropping off before the start of daily work and at periodical maintenance. Retighten the loosened fasteners, and install new ones for the dropped off fasteners. For the new machine, the check and retightening of fasteners must be carried out at first 50 hours operation. For the replacement of them, make sure to use the same size of the manufacturer's genuine parts.

Refer to the table below for the tightening and retightening of capscrews.

- The table below is not applicable for the capscrews to fix the cover, etc., made of plastic. For the tightening torque for such capscrews, consult with an authorized distributor. Over-tightening may cause damage on the parts to be fixed.
- If the tightening torque is specified in the manual, use such torque values regardless to the table below.
- Numerical indication on the capscREW head shows the classification for strength (e.g., 7 = 7 T). No indication is provided for smaller size capscrews, M5 or less.



11.1.1 Metric Coarse Thread Standard Tightening Torque Values. Make Certain to tighten all Capscrews & Nuts to proper torque values.

Torque value Unit : N•m (lbf•ft)

Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6	P=1	4.4±0.5 (3.2±0.4)	3.7±0.4 (2.7±0.3)	9.6±1.0 (7.1±0.7)	8.1±0.8 (6.0±0.6)	17.4±1.8 (12.8±1.3)	14.7±1.5 (10.8±1.1)
M8	P=1.25	10.7±1.1 (7.9±0.8)	9.0±0.9 (6.6±0.7)	23.5±2.0 (17.3±1.5)	19.6±2.0 (14.5±1.5)	42.2±3.9 (31.1±2.9)	35.3±3.9 (26.0±2.9)
M10	P=1.5	21.6±2.0 (15.9±1.4)	17.9±1.8 (13.2±1.3)	46.1±4.9 (34.0±3.6)	39.2±3.9 (28.9±2.9)	83.4±8.8 (61.5±6.5)	70.6±6.9 (52.1±5.1)
M12	P=1.75	36.3±3.9 (26.8±2.9)	31.4±2.9 (23.2±2.1)	79.4±7.8 (58.6±5.8)	66.7±6.9 (49.2±5.1)	143±15 (105±11)	121±12 (89.2±8.9)
M14	P=2	57.9±5.9 (42.7±4.4)	49.0±4.9 (36.1±3.6)	126±13 (92.9±9.6)	106±10 (78.2±7.4)	226±20 (167±15)	191±19 (141±14)
M16	P=2	88.3±8.8 (65.1±6.5)	74.5±6.9 (55.0±5.1)	191±20 (141±15)	161±16 (119±12)	343±39 (253±29)	284±29 (209±21)
M18	P=2.5	122±12 (90.0±8.9)	103±10 (75.8±7.2)	265±29 (195±21)	226±20 (167±15)	481±49 (355±36)	402±39 (297±29)
M20	P=2.5	172±17 (127±13)	144±14 (106±10)	373±39 (275±29)	314±29 (232±21)	667±69 (492±51)	559±59 (412±44)

HYDRAULIC EXCAVATOR

REPAIR MANUAL model **E55B**

INDEX

1	SPECIFICATIONS SECTION
2	MAINTENANCE SECTION
3	SYSTEM SECTION
4	DISASSEMBLY SECTION
5	TROUBLESHOOTING
6	ENGINE SECTION
7	PROCEDURE OF INSTALLING OPTIONS SECTION

SPECIFICATIONS

MAINTENANCE

SYSTEM

DISASSEMBLING

TROUBLESHOOTING

E/G

OPT.

GENERAL SAFETY INFORMATION

WARNING

Do not operate or perform any maintenance on this machine until all instructions found in the OPERATOR'S MANUAL and this MANUAL have been thoroughly read and understood.

Improper operation or maintenance of this machine may cause accidents and could result in serious injury or death.

Always keep the manual in storage.

If it is missing or damaged, place an order with an authorized Distributor for a replacement.

If you have any questions, please consult an authorized Distributor.

- (1) Most accidents, which occur during operation, are due to neglect of precautionary measures and safety rules. Sufficient care should be taken to avoid these accidents. Erroneous operation, lubrication or maintenance services are very dangerous and may cause injury or death of personnel. Therefore all precautionary measures, NOTES, DANGERS, WARNINGS and CAUTIONS contained in the manual and on the machine should be read and understood by all personnel before starting any work with or on the machine.
- (2) Operation, inspection, and maintenance should be carefully carried out, and safety must be given the first priority. Messages of safety are indicated with marks. The safety information contained in the manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
- (3) Messages of safety appear in the manual and on the machine. All messages of safety are identified by either word "DANGER", "WARNING" and "CAUTION".

- 1) **DANGER**- Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury and is represented as follows:

DANGER

- 2) **WARNING**- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury and is represented as follows:

WARNING

- 3) **CAUTION**- Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components and is represented as follows:

CAUTION

- (4) It is very difficult to forecast every danger that may occur during operation. However, safety can be ensured by fully understanding proper operating procedures for this machine according to methods recommended by the Manufacturer.
- (5) While operating the machine, be sure to perform work with great care, so as not to damage the machine, or allow accidents to occur.
- (6) Continue studying the manual until all Safety, Operation and Maintenance procedures are completely understood by all persons working with the machine.

SAFETY PRECAUTIONS

WARNING

The proper and safe lubrication and maintenance for this machine, recommended by the Manufacturer, are outlined in the OPERATOR'S MANUAL for the machine.

Improper performance of lubrication or maintenance procedures are dangerous and could result in injury or death. Read and understand the MANUAL before performing any lubrication or maintenance.

The serviceman or mechanic may be unfamiliar with many of the systems on this machine. This makes it important to use caution when performing service work. A knowledge of the system and or components is important before the removal or disassembly of any component.

Because of the size of some of the machine components, the serviceman or mechanic should check the weights noted in this manual. Use proper lifting procedures when removing any components. Weight of components table is shown in the section, SPECIFICATIONS.

The following is a list of basic precautions that must always be observed.

- (1) Read and understand all Warning plates and decals on the machine before Operating, Maintaining or Repairing this machine.
- (2) Always wear protective glasses and protective shoes when working around machines. In particular, wear protective glasses when using hammers, punches or drifts on any part of the machine or attachments. Use welders gloves, hood/goggles, apron and the protective clothing appropriate to the welding job being performed. Do not wear loose fitting or torn clothing. Remove all rings from fingers, loose jewelry, confine long hair and loose clothing before working on this machinery.
- (3) Disconnect the battery and hang a "Do Not Operate" tag in the Operators Compartment. Remove ignition keys.
- (4) If possible, make all repairs with the machine parked on a firm level surface. Block the machine so it does not roll while working on or under the machine. Hang a "Do Not Operate" tag in the Operators Compartment.
- (5) Do not work on any machine that is supported only by lift, jacks or a hoist. Always use blocks or jack

stands, capable of supporting the machine, before performing any disassembly.

WARNING

Do not operate this machine unless you have read and understand the instructions in the OPERATOR'S MANUAL. Improper machine operation is dangerous and could result in injury or death.

- (6) Relieve all pressure in air, oil or water systems before any lines, fittings or related items are disconnected or removed. Always make sure all raised components are blocked correctly and be alert for possible pressure when disconnecting any device from a system that utilizes pressure.
- (7) Lower the bucket, dozer, or other attachments to the ground before performing any work on the machine. If this cannot be done, make sure the bucket, dozer, ripper or other attachment is blocked correctly to prevent it from dropping unexpectedly.
- (8) Use steps and grab handles when mounting or dismounting a machine. Clean any mud or debris from steps, walkways or work platforms before using. Always face to the machine when using steps, ladders and walkways. When it is not possible to use the designed access system, provide ladders, scaffolds, or work platforms to perform safe repair operations.
- (9) To avoid back injury, use a hoist when lifting components which weigh 20 kg (45 lbs) or more. Make sure all chains, hooks, slings, etc., are in good condition and are the correct capacity. Be sure hooks are positioned correctly. Lifting eyes are not to be side loaded during a lifting operation.
- (10) To avoid burns, be alert for hot parts on machines which have just been stopped and hot fluids in lines, tubes and compartments.
- (11) Be careful when removing cover plates. Gradually back off the last two capscrews or nuts located at opposite ends of the cover or device and carefully pry cover loose to relieve any spring or other pressure, before removing the last two capscrews or nuts completely.
- (12) Be careful when removing filler caps, breathers and plugs on the machine. Hold a rag over the cap or plug to prevent being sprayed or splashed by liquids under pressure. The danger is even greater if the machine has just been stopped because fluids can be hot.

11. TOOLS

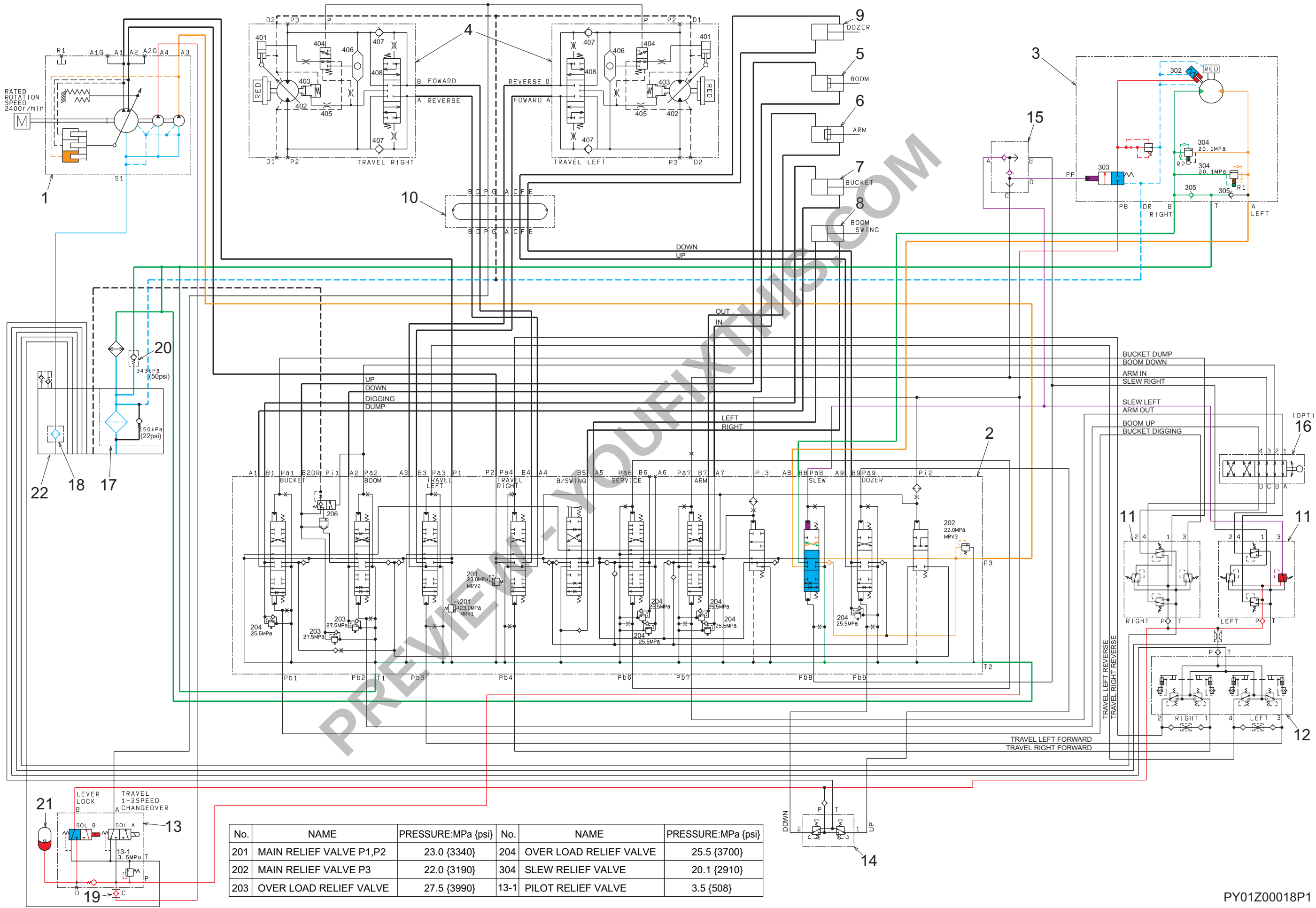
Torque value Unit : N•m (lbf•ft)

Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M22	P=2.5	226±20 (167±15)	192±20 (142±15)	500±49 (369±36)	422±39 (311±29)	902±88 (665±65)	755±78 (557±58)
M24	P=3	294±29 (217±21)	235±29 (173±21)	637±69 (470±51)	520±49 (383±36)	1160±118 (856±87)	941±98 (694±72)
M27	P=3	431±39 (318±29)	353±39 (260±29)	941±98 (694±72)	765±78 (564±58)	1700±167 (1250±123)	1370±137 (1010±101)
M30	P=3.5	588±59 (434±44)	490±49 (361±36)	1285±127 (948±94)	1079±108 (796±80)	2300±235 (1700±173)	1940±196 (1430±145)
M33	P=3.5	794±78 (586±58)	667±69 (492±51)	1726±177 (1270±131)	1451±147 (1070±108)	3110±314 (2290±232)	2610±265 (1930±195)
M36	P=4	1030±98 (760±72)	863±88 (637±65)	2226±226 (1640±167)	1863±186 (1370±137)	4010±402 (2960±297)	3360±333 (2480±246)

11.1.2 Metric Fine Thread Standard Tightening Torque values. Make certain to tighten all Capscrews & Nuts to proper torque values.

Torque value Unit : N•m (lbf•ft)

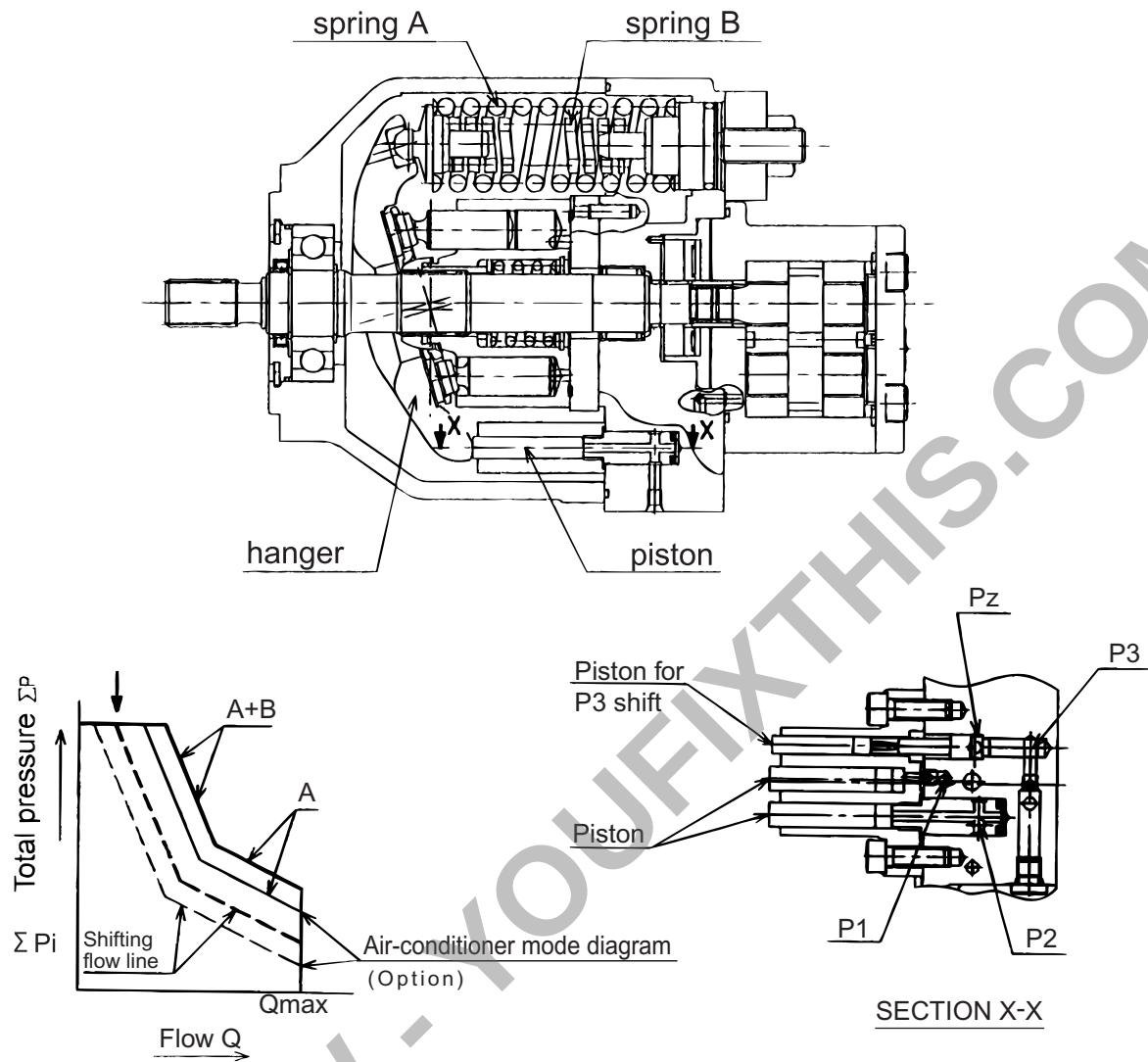
Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M8	P=1.0	11.3±1.1 (8.3±0.8)	9.5±1.0 (7.0±0.7)	24.5±2.0 (18.1±1.5)	20.6±2.0 (15.2±1.5)	44.1±3.9 (32.5±2.9)	37.3±3.9 (27.5±2.9)
M10	P=1.25	22.6±2.0 (16.7±1.5)	18.7±1.9 (13.8±1.4)	48.1±4.9 (35.5±3.6)	41.2±3.9 (30.3±2.9)	87.3±8.8 (64.4±6.5)	73.5±6.9 (54.2±5.1)
M12	P=1.25	39.2±3.9 (28.9±2.9)	33.3±2.9 (24.6±2.1)	85.3±8.8 (62.9±6.5)	71.6±6.9 (52.8±5.1)	154±16 (114±12)	129±13 (95.2±9.6)
M16	P=1.5	92.2±8.8 (68.0±6.5)	77.5±7.8 (57.2±5.8)	196±20 (145±15)	169±17 (125±13)	363±39 (268±29)	304±29 (224±21)
M20	P=1.5	186±19 (137±14)	155±16 (114±12)	402±39 (297±29)	333±29 (246±21)	726±69 (535±51)	608±59 (448±44)
M24	P=2	314±29 (232±21)	265±29 (195±21)	686±69 (506±51)	569±59 (420±44)	1240±118 (915±87)	1030±98 (760±72)
M30	P=2	637±59 (470±44)	530±49 (391±36)	1390±137 (1030±101)	1157±118 (853±87)	2500±255 (1840±188)	2080±206 (1530±152)
M33	P=2	853±88 (629±65)	706±70 (521±52)	1860±186 (1370±137)	1550±155 (1140±114)	3350±334 (2470±246)	2790±275 (2060±203)
M36	P=3	1070±108 (789±80)	892±88 (658±65)	2330±226 (1720±167)	1940±196 (1430±145)	4200±422 (3100±311)	3500±353 (2580±260)



Slewing Circuit: Slewing Left Operation

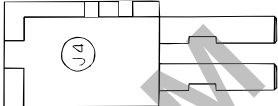
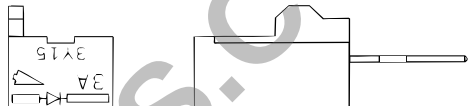
24. COMPONENTS SYSTEM

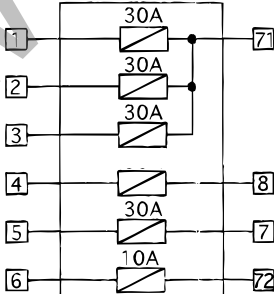
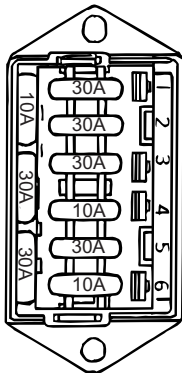
2. Control



- The delivery pressure $P1$ and $P2$ are directed to the piston which slides on the hanger and acts on the hanger.
- The spring is provided to act against the delivery pressure.
- When the oil pressure via piston acting on the hanger is less than the installation load of the spring, the hanger is fixed to the maximum tilting position.
- When the oil pressure via piston acting on the hanger exceeds the installation load of the spring, the hanger is tilted and kept tilted at a position where the oil pressure is balanced with the spring forces. (Region A in above Figure.)
- When the oil pressure acting on the piston rises further to reduce the tilting angle, the spring B which has been inactive up to now becomes active.
- To overcome the spring force of two springs, the oil pressure must be higher and the shifting line becomes more steep. (Regions A + B in the middle of the figure above.)
- When the $P3$ oil pressure acts on the shift piston, the control shifting line is shifted.
- When outside oil pressure ($Pz=3.4\text{MPa}$) acts on the Z port, the air-conditioner mode is available. When the Z port is not in use, the piping is connected to the drain line.

24.2.2 SPECIFICATIONS ELECTRICAL EQUIPMENT

Code No. Parts Name Parts No. Use Applicable Machine	Specifications	Description												
D-1, 2, 3, 4, 5, 12, 14, 18, 19	<table><tr><td colspan="2">Type</td><td>7321-9822-30</td></tr><tr><td rowspan="2">Max rated</td><td>Current</td><td>3A</td></tr><tr><td>Breakdown</td><td>400V</td></tr></table>	Type		7321-9822-30	Max rated	Current	3A	Breakdown	400V					
Type		7321-9822-30												
Max rated	Current	3A												
	Breakdown	400V												
Diode														
YN02D01001P1														
Horn E/G stop solenoid E/G stop relay Travel 1, 2 speed sol. Battery relay Slew/Swing Select relay E/G stop solenoid	<p>Mating connector</p> <table><tr><th></th><th>Maker</th><th>Housing</th><th>Terminal</th></tr><tr><td>2poles</td><td>YAZAKI SUMITOMO</td><td>7123-7729-40 6098-0017</td><td>7116-1181P</td></tr><tr><td>4poles</td><td>YAZAKI</td><td>7123-7144</td><td>7116-1181P</td></tr></table>		Maker	Housing	Terminal	2poles	YAZAKI SUMITOMO	7123-7729-40 6098-0017	7116-1181P	4poles	YAZAKI	7123-7144	7116-1181P	
	Maker	Housing	Terminal											
2poles	YAZAKI SUMITOMO	7123-7729-40 6098-0017	7116-1181P											
4poles	YAZAKI	7123-7144	7116-1181P											
PW10-22001~ PX11-08901~ PW11-30001~ PX12-11001~ PH05-03501~ PJ04-03001~ PJ05-06001~ PJ06-08001~ PJ06-08890~ PJ06-09807~ PS02-00101~														

E-1	<table><tr><td>Spare fuse</td><td>10A one, 30A two</td></tr></table>	Spare fuse	10A one, 30A two											
Spare fuse	10A one, 30A two													
Fuse box														
PW73E00003F1														
Circuit protection														
PJ05-06001~ PJ06-08001~ PJ06-08890~ PJ06-09807~ PS02-00101~	<p>Connection</p> 	<table><tr><td>F1</td><td>Wiper Heater</td></tr><tr><td>F2</td><td>Relay Solenoid</td></tr><tr><td>F3</td><td>Working light</td></tr><tr><td>F4</td><td>Horn Room lamp</td></tr><tr><td>F5</td><td>Engine stop Solenoid</td></tr><tr><td>F6</td><td>Battery relay Gauge cluster</td></tr></table>	F1	Wiper Heater	F2	Relay Solenoid	F3	Working light	F4	Horn Room lamp	F5	Engine stop Solenoid	F6	Battery relay Gauge cluster
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32. ATTACHMENTS

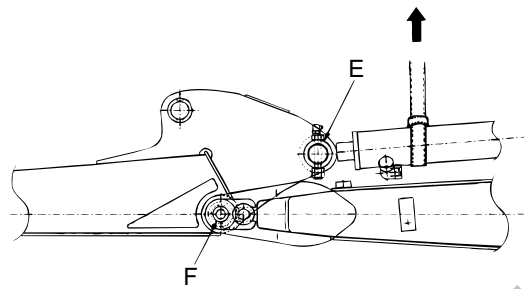
(4) Lift up the arm cylinder body with a nylon sling in order not to exert any load to the pin (E).

(5) Remove the capscrew and nuts that are preventing the pin (E) from coming off. Then remove the pin (E) and shims.

Tools: Spanner: 19 mm

(6) Placing a wood block under the arm cylinder, let down the cylinder.

(7) Install the pin (E) to the original position, and install the capscrew and nuts that prevent the pin (E) from coming off. Attaching a rope to the pin (E) and the arm tip, slightly lift it up in order not to exert any load to the pin (F).



PIN (F) PORTION

PIN (E) PORTION

Sectional View of Installing Pin

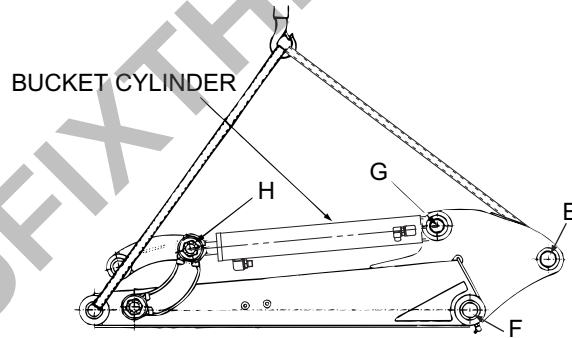
(8) Remove the capscrew that is preventing the pin (F) connecting the arm and boom, from coming off. Then pull off the pin (F).

Tools: Spanner: 36 mm

(9) Remove the arm assembly paying attention to the stability of arm.

Weight of arm assembly: approx.

230 kg (507 lbs) - E55B



Removal Of Arm Assembly

(10) Removal of Bucket Cylinder

1. Remove the capscrew that is preventing the rod pin (H) from coming off, then pull off the pin (H).

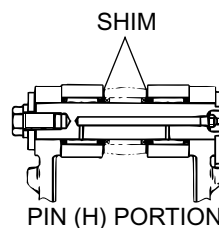
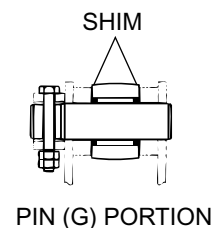
Tools: Spanner: 24 mm

2. Remove the capscrew and nuts that are preventing the head pin (G) from coming off, then pull off the pin (G).

Tools: Spanner: 19 mm

3. Apply a nylon sling to the tube of bucket cylinder, and remove the cylinder.

Weight: approx. 31kg (68.4 lbs)



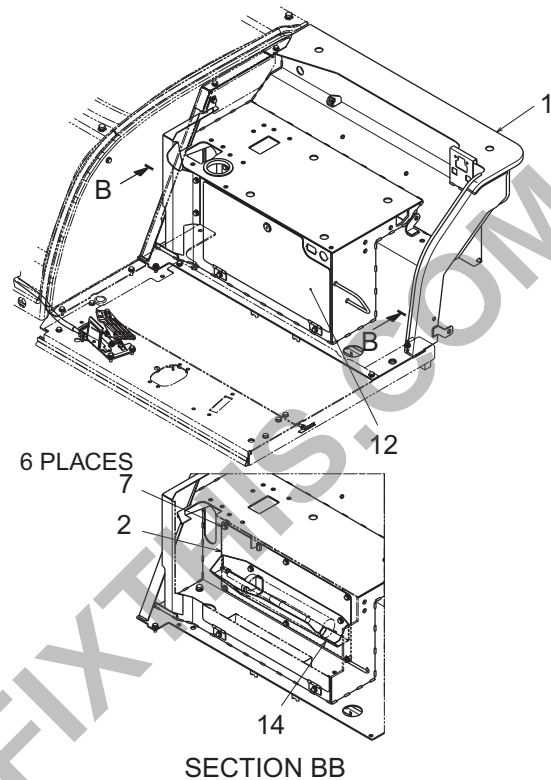
Sectional View Of Installing Pin

33. UPPER SLEWING STRUCTURE

33.1.16 STARTER

33.1.16.1 REMOVAL PREPARATION

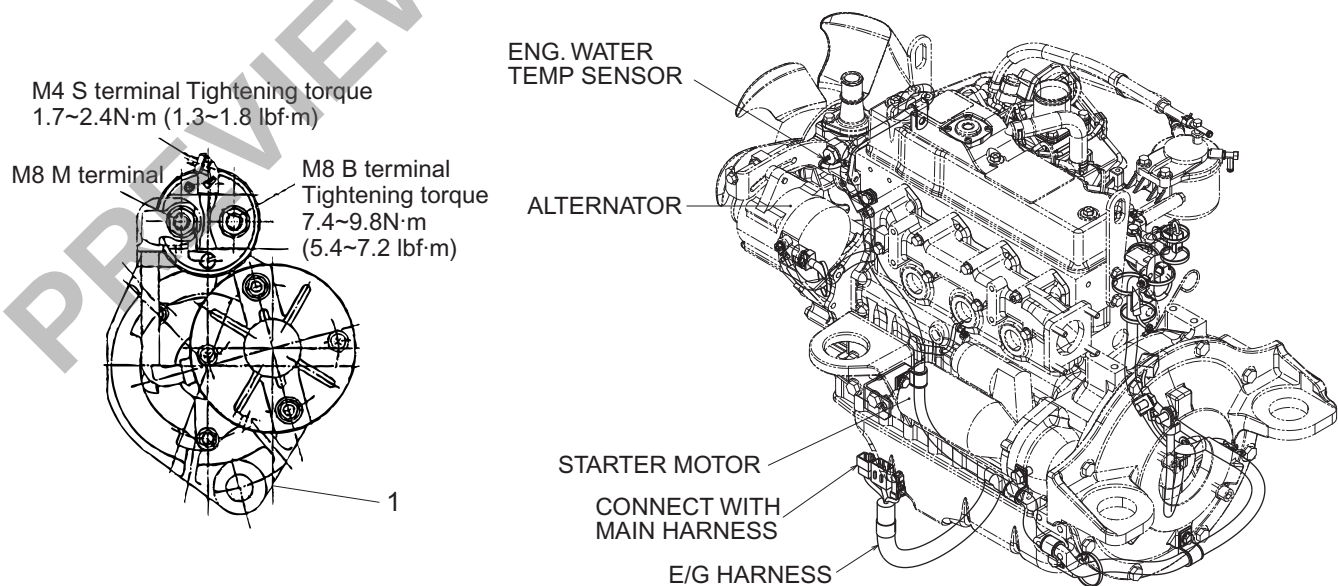
- (1) Open the cover (12).
- (2) Remove the cover (2) in stand (1).
Loosen six M8 X 16 sems-bolts (7) to remove the cover (2).
Tools: Socket 13mm
Tightening torque: 23 N·m (17 lb·ft)
- (3) Disconnect the negative terminal on the battery.



Seat and Cover Removal

33.1.16.2 REMOVAL

- (1) Remove the M8 nut for terminal B of the starter.
Tools: Socket 13mm
- (2) Disconnect the connector on terminal S of the starter.
- (3) Loosen two fastening bolts (1) to remove the starter.
Tools: Socket 19mm



Starter Removal

33.1.16.3 INSTALLATION

Install starter in reverse order of the removal.

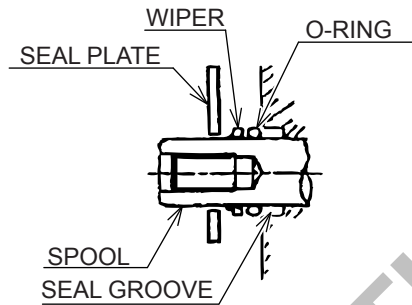
(5) Assembling Swing Section / Manual Operation

1. Install O-ring (4), wiper (5), and seal plate (3) in spool (2) in order, and put spring (9) between spring seats (7), and attach it to the spool with cap screw (8) (opposing flats 5 mm). Then be sure to assemble the spool sandwiching it between wood blocks and fixing it to a vice to protect the outside surface from damage (see 33.2.2.4 (5) Fig. "Connecting Port Relation").

Tightening torque: 19 to 22 N-m (14 to 16.2 lb-ft)

2. Place previously sub-assembled spool in valve housing (1) and attach O-ring (4), wiper (5), and seal plate (3) on other side with machine screw (13).

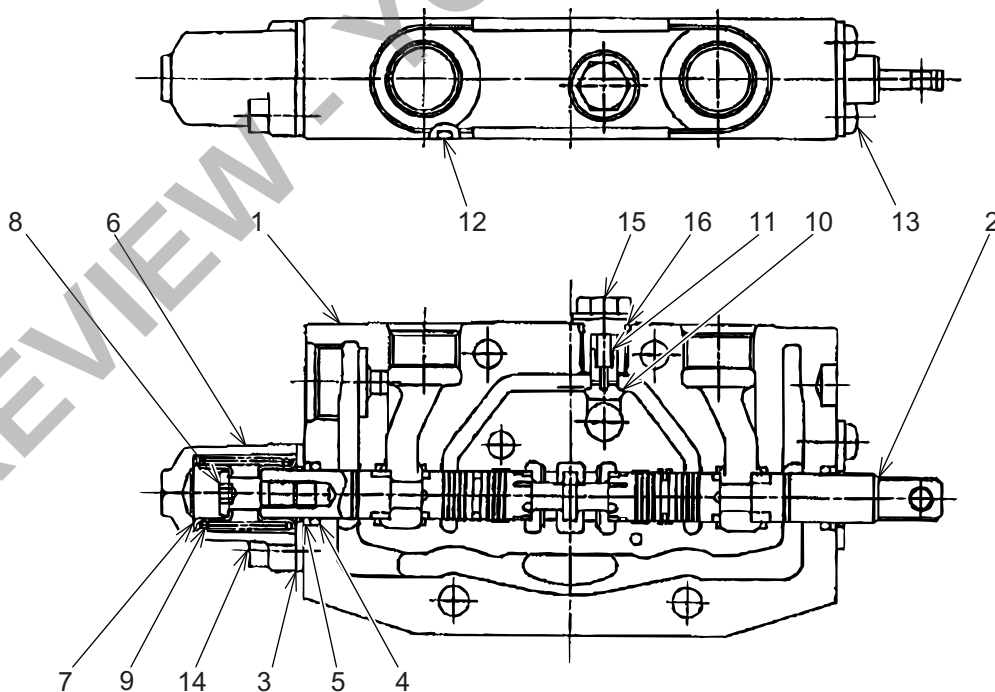
Tightening torque: 2.5 to 2.9 N-m (22 to 25.7 lb-in)



Wiper (5) Installing Direction



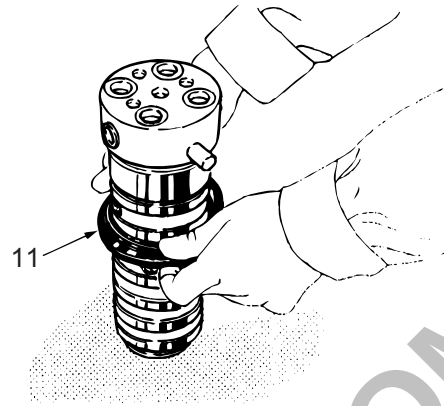
Ensure the wiper (5) is in the correct direction.



Swing Section

33. UPPER SLEWING STRUCTURE

(4) Remove dust seal (11) from the stem (1).



(5) Remove seal, etc. from the inside of the body.
Be sure of the position of the seal, etc., referring to the construction drawing.
Take out O-ring with a pointed tool like a gimlet.

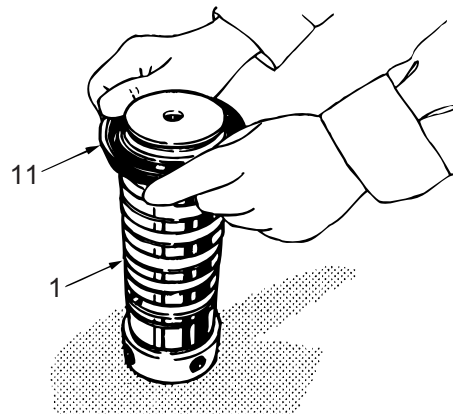


33.2.6.2.3 Assembling

(1) Insert seals in the body.
Check the seal position referring to the construction drawing.
Ensure that O-rings are free from twisting.
Do not deform or bend the slipper seal.

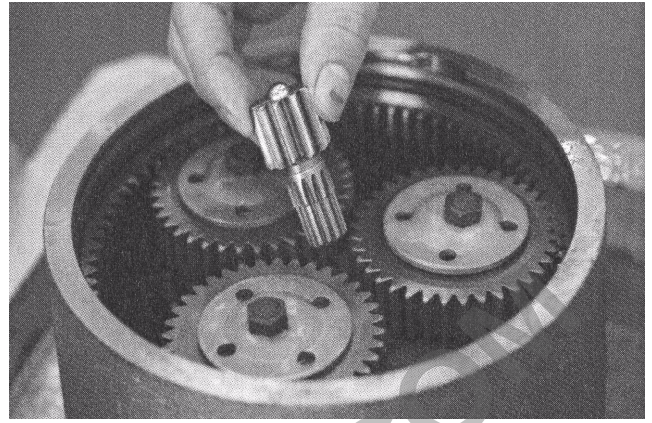


(2) Install dust seal (11) to stem (1).
Apply enough grease to the lip section of the dust seal.

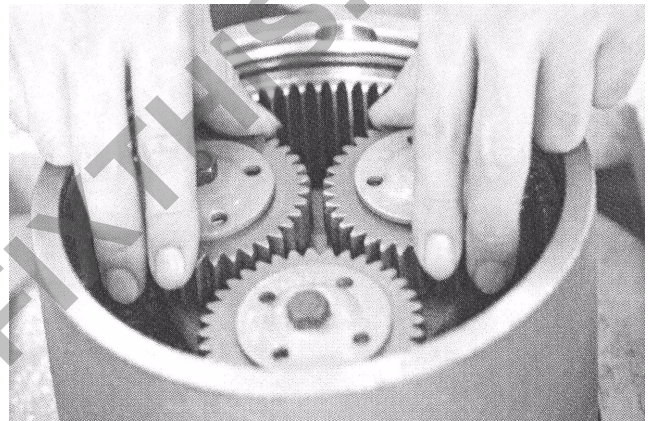


(5) Removing sun gear 1 (4)

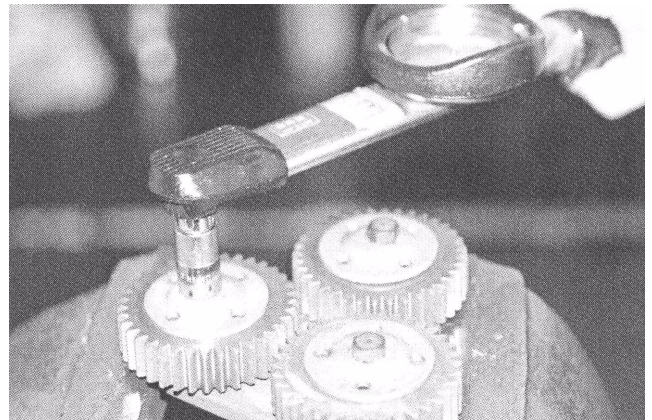
1. Pull out the sun gear 1 (4) by hand.
2. Remove the steel balls (41) from the sun gear 1 (4).
-The coupling (14) may come off at the same time.

**Removing Sun Gear 1 (4)****(6) Removing carrier assembly**

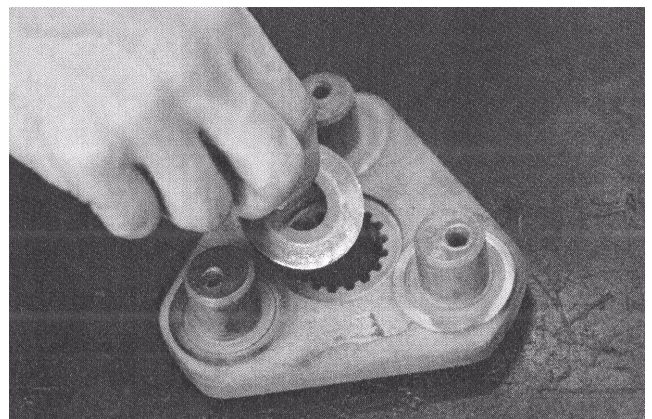
1. Take out the carrier assembly from the hub (1).
2. Take out the sun gear 2 (6) from the hub.
3. Remove the coupling (14) from the shaft (102).

**Removing Carrier Assembly****4. Disassembling carrier assembly**

- a. Loosen the hexagonal head screws (40) and remove them from carrier (3).
- b. Remove three thrust washers (12), three planetary gears 1 (5), three needle roller bearings with retainers (27) and three bearing inner races (29) from the carrier (3).

**Disassembling Carrier Assembly**

5. Remove the thrust washer 1 (9) from the carrier (3).

**Removing Thrust Washer (9)**

44.1 TROUBLE DIAGNOSIS: ENGINE

Classification	Group No.	Cause	Serviceman															
			Inspection												Visual check			
			Filters						Fluid						Gas/fluid			
			No fuel or leakage	Air or water entered fuel system	Oil filter clogged	Air cleaner clogged	Primary fuel filter clogged	Fuel filter clogged	Fan belt slip	Breather hose clogged or depressed	Coolant level	Poor quality fuel or leakage	Improper specific gravity of battery electrolyte	Improper viscosity or level of engine oil, or leakage	Poor quality fuel or heavy oil used	Large amount of blowby gas	Gas leakage through valve gasket	Excessive amount of engine oil
Starting trouble	1	(1) Starter not rotate																
		(2) Starter rotates but hard to start	○	○		○	○	○					○	○	○			
Rotation trouble	2	(1) Idling not smooth		○			○	○							○			
		(2) Medium speed hunting												○				
		(3) High speed not smooth		○				○										
		Not reach max. speed						○										
Output drops down	3	(1) Engine output not enough		○		○		○					○	○	○	○		
		Overheat			○	○			○		○		○					
		(2) Knocking at high temperature												○	○	○		
Other trouble	4	(1) Large amount of black exhaust gas			○								○				○	
		White exhaust gas		○											○	○		
		(2) Excessive oil consumption							○					○	○		○	
		(3) Excessive fuel consumption			○						○		○		○			
		(4) Engine not stop when key turned OFF																
		(5) When key is turned OFF, power supply disconnected but engine not stop																

LOCATION OF LABELS

Figure 4-3 shows the location of regulatory and safety labels on Yanmar TNV series engines.

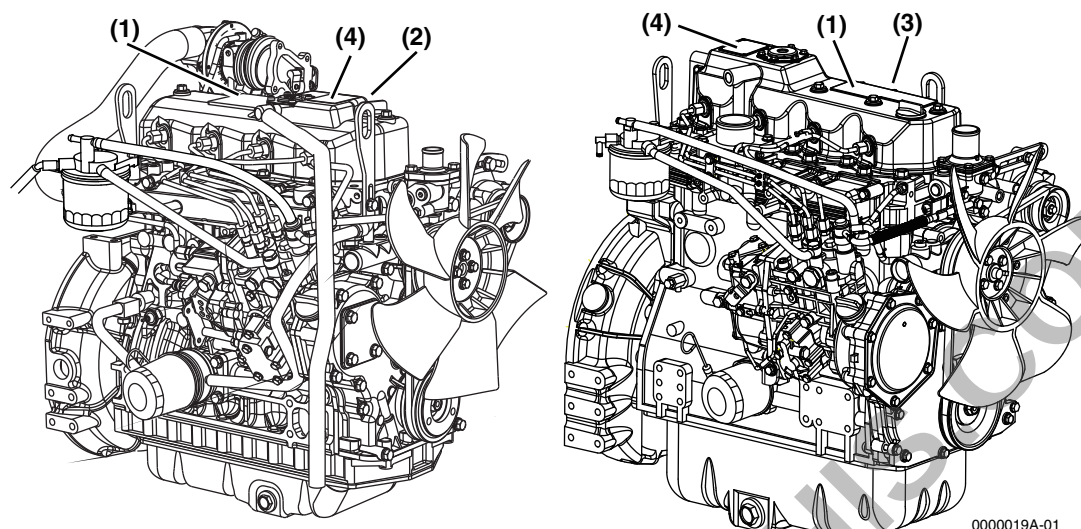


Figure 4-3

Location of labels/nameplates on direct injection model engines

Model	Engine Nameplate	EPA/ARB Certification Label	97/68/EC Emission Control Label
3TNV82A,3TNV84,3TNV84T,3TNV88 3TNV82A-B,3TNV88-B,3TNV88-U 3TNV84T-B	On the top of the locker arm cover(cooling fan end) Figure 4-3 left, (4)	On the top of the locker arm cover (flywheel end) Figure 4-3 left, (1)	On the exhaust side of the locker arm cover(near the flywheel) Figure 4-3 left, (2)
4TNV84,4TNV88,4TNV84T 4TNV88-B,4TNV88-U,4TNV84T-Z	On the top of the locker arm cover(cooling fan end) Figure 4-3 left, (4)	On the top of the locker arm cover(flywheel end) Figure 4-3 left, (1)	On the exhaust side of the locker arm cover(near the flywheel) Figure 4-3 left, (1)
4TNV94L,4TNV98,4TNV98T 4TNV106,4TNV106T 4TNV98-Z,4TNV98-E,4TNV98T-Z	On the top of the locker arm cover(flywheel end) Figure 4-3 right, (4)	On the top of the locker arm cover(center) Figure 4-3 right, (1)	On the top of the locker arm cover(fan end) Figure 4-3 right, (3)

CAUTION

NEVER hold the key in the **START** position for longer than 15 seconds or the starter motor will overheat.

0000007en

CAUTION

For maximum engine life, Yanmar recommends that when shutting the engine down, you allow the engine to idle, without load, for five minutes. This will allow the engine components that operate at high temperatures, such as the turbocharger (if equipped) and exhaust system, to cool slightly before the engine itself is shut down.

0000008en

CAUTION

NEVER use an engine starting aid such as ether. Engine damage will result.

0000009en

CAUTION

Make sure the engine is installed on a level surface. If a continuously running engine is installed at an angle greater than (IDI = 25°, DI = 30°) in any direction or if an engine runs for short periods of time (less than three minutes) at an angle greater than (IDI = 30°, DI = 35°) in any direction, engine oil may enter the combustion chamber causing excessive engine speed and white exhaust smoke. This may cause serious engine damage.

0000010enTNV

CAUTION

New Engine Break-in:

- On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper engine oil pressure, diesel fuel leaks, engine oil leaks, coolant leaks, and for proper operation of the indicators and / or gauges.
- During the first hour of operation, vary the engine speed and the load on the engine. Short periods of maximum engine speed and load are desirable. Avoid prolonged operation at minimum or maximum engine speeds and loads for the next four to five hours.
- During the break-in period, carefully observe the engine oil pressure and engine temperature.
- During the break-in period, check the engine oil and coolant levels frequently.

0000011en

CAUTION

NEVER engage the starter motor while the engine is running. This may damage the starter motor pinion and / or ring gear.

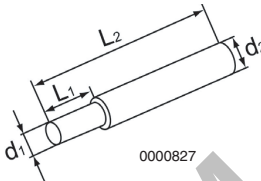
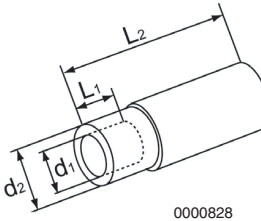
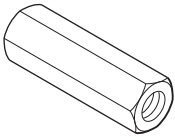
0000012en

CAUTION

It is important to perform daily checks. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the engine.

0000060en

SPECIAL SERVICE TOOLS

No.	Tool Name	Applicable Model and Tool Size					Illustration
1	Valve Guide Tool (For Removing Valve Guide)						
		Model	L1	L2	d1	d2	
		3TNV82A 4TNV94L, 4TNV98, 4TNV98T 4TNV106, 4TNV106T	0.787 in. (20 mm)	2.953 in. (75 mm)	0.256 in. (6.5 mm)	0.394 in. (10 mm)	
		4TNV84, 3TNV84, 3TNV84T, 3TNV88, 4TNV88	0.787 in. (20 mm)	2.953 in. (75 mm)	0.295 in. (7.5 mm)	0.433 in. (11 mm)	
		4TNV84T	0.787 in. (20 mm)	2.953 in. (75 mm)	0.217 in. (5.5 mm)	0.354 in. (9 mm)	
		Locally Manufactured					
2	Valve Guide Tool (For Installing Valve Guide)						
		Model	L1	L2	d1	d2	
		3TNV82A	0.472 in. (12 mm)	2.362 in. (60 mm)	0.512 in. (13 mm)	0.748 in. (19 mm)	
		4TNV84, 3TNV84, 3TNV84T, 4TNV88, 4TNV88	0.591 in. (15 mm)	2.559 in. (65 mm)	0.551 in. (14 mm)	0.787 in. (20 mm)	
		4TNV84T	0.335 in. (8.5 mm)	2.362 in. (60 mm)	0.433 in. (11 mm)	0.669 in. (17 mm)	
		4TNV94L, 4TNV98, 4TNV98T	0.276 in. (7 mm)	2.362 in. (60 mm)	0.512 in. (13 mm)	0.630 in. (16 mm)	
		4TNV106, 4TNV106T	0.535 in. (13.6 mm)	2.559 in. (65 mm)	0.512 in. (13 mm)	0.630 in. (16 mm)	
		Locally Manufactured					
3	Fuel Injector Removal Tool (2-Valve Head)	Yanmar Part No. 129470-92305					

10. To measure piston ring end gap, insert each compression piston ring (**Figure 6-118, (1)**), one at a time, into the cylinder. Use a piston with the piston rings removed to slide the ring into the cylinder bore until it is approximately 1.18 in. (30 mm) (**Figure 6-118, (2)**) from the bottom of the bore. Remove the piston. Measure the end gap (**Figure 6-118, (3)**) of each piston ring. Record the measurements. See *Piston Ring* on page 6-18 for specifications.

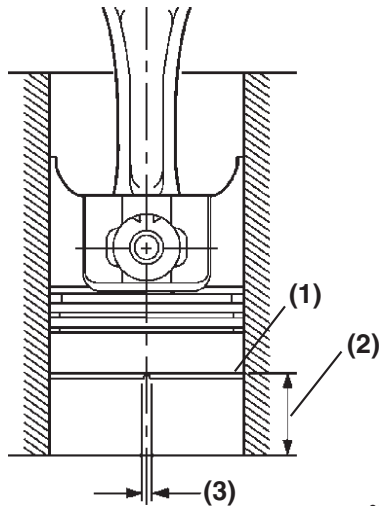


Figure 6-118

Note: Always check the piston ring end gap when installing new piston rings. See *Piston Ring* on page 6-18 for specifications. Use a piston ring end gap filing tool to adjust the piston ring end gap on new piston rings.

11. Repeat the above steps for each cylinder and piston assembly.

Inspection of Connecting Rod

1. Measure the wrist pin bushing bore using a bore gauge (**Figure 6-119, (1)**). Replace the bushing if not within specifications. If the bushing has been removed, measure the inside diameter of the connecting rod small end (**Figure 6-119, (2)**). See *Connecting Rod* on page 6-22 for specifications.

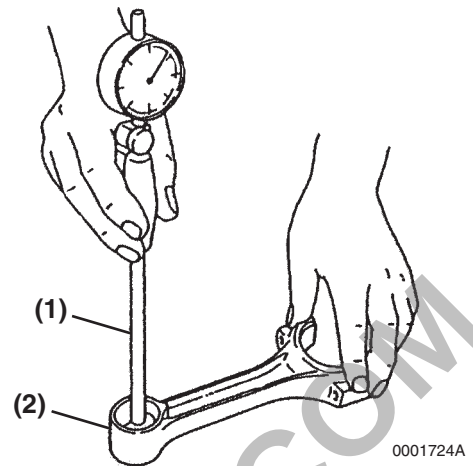


Figure 6-119

2. Place the connecting rod bearing inserts into the connecting rod and connecting rod cap. Install the rod cap and tighten the bolts to the specified torque.
3. Measure the inside diameter. See *Crankshaft* on page 6-14 for specifications.

Inspection of Tappets

1. Inspect the tappet contact surfaces for abnormal wear (**Figure 6-120, (1)**). Normal wear will be even as shown in (**Figure 6-120, (2)**). Slight surface defects can be corrected using an oilstone.

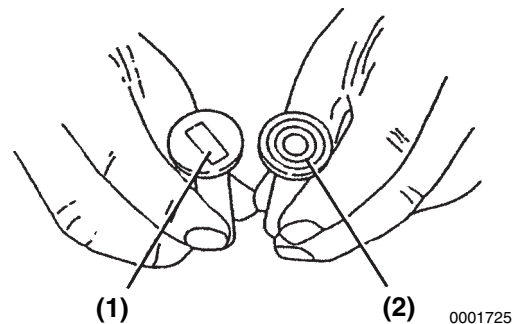


Figure 6-120

13. If the injection timing is correct, remove the dial indicator and adapter. Replace the pump plunger plug and its copper gasket and tighten to specifications. Replace the flywheel inspection port cover. Open the fuel supply valve and remove the clamp from the fuel supply hose and the fuel return hose.
14. Prime the fuel system. Operate the engine and check for leaks.

Adjusting Fuel Injection Timing

If the timing marks did not align when performing the *Checking Fuel Injection Timing* on page 7-31, the following steps must be performed to properly time the engine.

1. Leave the dial indicator installed in the fuel injection pump. Do not disturb the reading on the dial indicator.
2. Rotate the flywheel until the target timing mark (**Figure 7-46, (1)**) and the timing reference mark (**Figure 7-46, (2)**) on the flywheel housing or back plate are aligned.

IMPORTANT

Do not rotate the crankshaft during the remainder of this procedure.

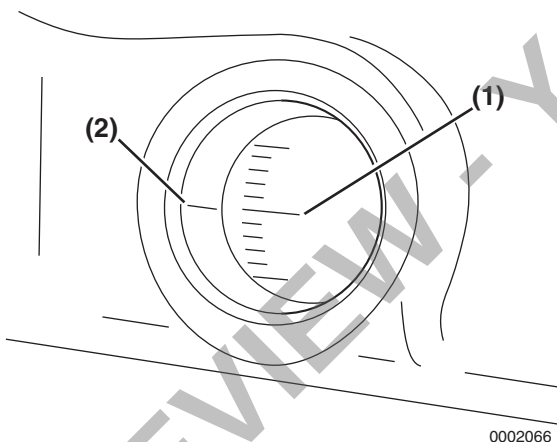


Figure 7-46

3. Note the reading on the dial indicator (**Figure 7-47, (1)**). If the reading is less than 2.5 mm (0.098 in.), the fuel injection timing is “retarded.” If the dial indicator reading is greater than 2.5 mm (0.098 in.), the fuel injection timing is “advanced.”

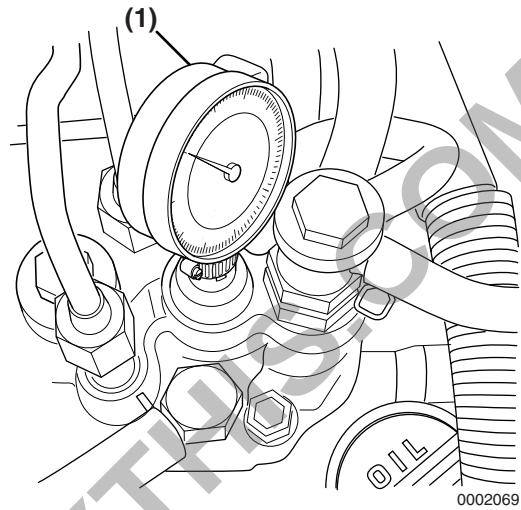


Figure 7-47

Note: Some model engines require the intake manifold and fuel injection pump insulator be removed to access the inner fuel injection pump retaining nuts.

4. Loosen the nuts fastening the fuel injection pump to the gear case or front plate. Loosen the rear bracket(s) on the fuel injection pump.

Note: Loosening the high-pressure injection line nuts on the fuel injection pump may make rotating the pump easier.

5. Rotate the fuel injection pump until the dial indicator reads 2.5 mm (0.098 in.).
6. To “advance” the injection timing, rotate the top of the fuel injection pump away from the engine.
7. To “retard” the injection timing, rotate the top of the fuel injection pump toward the engine.
8. When the dial indicator reads 2.5 mm (0.098 in.) of pump plunger lift and the target timing mark on the flywheel aligns with the reference mark on the flywheel housing or engine back plate, the injection timing is correct.

PERIODIC INSPECTION

Inspect the turbocharger at regularly scheduled intervals.

Application	Inspection interval					
	200 hours	400 hours	500 hours	800 hours	1000 hours	2000 hours
Construction Equipment			First 6 months or 500 hrs		First 12 months or 1000 hrs	Every 24 months or 2000 hrs
Farm Equipment	First 6 months or 200 hrs	First 12 months or 400 hrs		Every 24 months or 800 hrs		
Engine Oil and Filter Replacement	Based on engine operation manual					

Visual Inspection

1. Check for indications of oil leaks at the oil inlet and outlet lines. Repair or replace the oil lines as needed.
2. Inspect the air inlet connection to the turbocharger's turbine side for cracks or broken hardware. Repair or replace the connection as needed.
3. Inspect the exhaust outlet connection to the turbocharger's compressor side for cracks or broken hardware. Repair or replace the connection as needed.

Inspection of Rotor Rotation

1. With the engine cool and not operating, manually rotate the rotor. Smooth rotation is normal. Any catching or resistance to rotation is an indication of abnormal operation. Replace the turbocharger or have it repaired by a qualified repair facility.
2. Start the engine.
3. After the engine reaches normal operating temperature, place a stethoscope firmly against the turbocharger case.
4. Increase the rpm gradually. A high-pitched sound, occurring at intervals of two or three seconds, is an indication of abnormal operation. Replace the turbocharger or have it repaired by a qualified repair facility.

Inspection of Rotor Play

To inspect the rotor, the turbocharger must be removed. Inspect for maximum rotor end play and run-out limits before reinstalling.

Removal of Turbocharger

1. Shut down the engine and allow the turbocharger to cool. Remove the exhaust outlet connection from the turbocharger housing.
2. Remove the air inlet connection from the turbocharger housing.

CAUTION

Do not allow any material to fall into the oil lines or the oil inlet and outlet ports of the turbocharger.

0000064en

3. Remove the inlet and outlet oil lines from the turbocharger. Plug the lines and ports with tape to prevent contamination. Discard the sealing washers and O-rings. Inspect the oil lines and replace if damaged.
4. Remove the turbocharger mounting nuts from the mounting studs. Lift the turbocharger from the engine and place it on a clean, level working surface.
5. Discard the turbocharger exhaust manifold gasket.

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